ZOOGOER

MAY • JUNE 1994

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ZOOGOER

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Out of the Mist. *1987. Nancy Hogan Armour. Island Gallery & Gifts, 6219 Maddox Blvd., Chincoteague Island, VA 23336. This is one of a series of prints Ms. Armour has produced for the annual Assateague and Chincoteague pony swim.*

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is a nonprofit organization of individuals, families, and organizations who are interested in helping to maintain the status of the National Zoological Park as one of the world's great zoos, to foster its use for education, research, and recreation, to increase and improve its facilities and collections, and to advance the welfare of its animals.

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Director: Michael H. Robinson.

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Zoo in the Country

The rolling hills of the Blue Ridge in rural western Virginia seem an unlikely place to find an international conservation organization. But there it is. From 3,200 acres of field and forest near Front Royal, the National Zoo's Conservation and Research Center (CRC) reaches out to influence conservation activities around the world.

Established in 1975 primarily to provide spacious enclosures for breeding endangered species, CRC's mission and scope has steadily grown to encompass a diverse array of conservation purposes. CRC scientists study local wildlife such as migratory birds and white-tailed deer, as well as exotic wildlife such as Eld's deer and Guam rails. CRC scientist–educators travel the globe to teach biologists in developing countries the principles of wildlife conservation and management and of zoo management. Students also come to CRC each summer for similar courses and return home with better skills to protect their wildlife.

Most recently, CRC is developing conservation education programs for the people in its neighboring communities as well as for teachers around the world, recognizing that conservation will never succeed unless everyone understands its importance.

To help support all of these programs, FONZ has launched the CRC Safari Club, a special add-on to your FONZ membership. For a $25 contribution over your regular dues, you can join the CRC Safari Club to support CRC's work and become eligible for excit-ing benefits. As a club member, you can visit CRC, which is usually closed to the public, meet CRC scientists, and even participate actively in ongoing research programs at CRC. You will also receive a newsletter to keep up on the Center's work, and, if you go on any of FONZ's international safaris, you'll have the opportunity to meet conservation biologists who belong to CRC's global network.

The CRC Safari Club is a great way for FONZ members to get involved in a unique area of the Zoo and to support its vital conservation mission. CRC Safari Club members are invited to attend our first outing to the Center this July. To join the club, to receive more information, or to arrange to attend the July outing, please call the FONZ Membership Department at 202.673.4961.

Sincerely,

Clinton A. Fields
Executive Director

Corralling Controversy

Home, home on the range,
Where the deer and the antelope play,
Where seldom is heard a discouraging word,
And the skies are not cloudy all day.

Change the words to "where the wild horses play," and you get a more accurate picture of many rangelands today. Wild horses have long been cherished as symbols of the untamed West, and many Americans hold dear the image of wild horses with flowing manes and thundering hooves running unfettered through vast expanses of western mountains and scrubland. But horses are not native to our country and, ironically, if unchecked, they will help destroy the very lands they evoke so powerfully. And that is discouraging.

Until about 8,000 years ago, North America had its own native horses. In fact, the horse family (Equidae) evolved in North America roughly 60 million years ago, making it among the oldest of ungulate (hooved mammal) families. Horses reached Asia by crossing what was then the Bering Land Bridge and then spread to Europe and Africa. Just as the African savannas today have many antelope species, North America once had a great diversity of horse species. However, for unknown reasons, there was a considerable decline in horse diversity during the late Miocene. Today, the horse family comprises only seven species of horses, asses, and zebras.

North America remained free of equids until the 1500s, when Spanish settlers introduced the domestic horse (*Equus caballus*), a species native to Eurasia that was domesticated about 5,000 years ago in Asia. The

Robin Meadows
Photographs by Joel Berger

Descendants of horses brought to the Americas by the Spanish nearly 500 years ago, wild horses are considerably different in appearance than modern ranch horses.

Cows on the Range

Drive almost anywhere in the western United States and you will see them: cows dot the land, grazing placidly and relentlessly. While they have been there for as long as anyone can remember, cattle are not native to our country and have helped change the Great Basin and other rangelands to such an extent that they would be hardly recognizable to the Europeans who brought cows to the New World centuries ago.

"We have a problem with too many cows on our public lands, and many of them ought to be removed...to maintain the stability of our fragile desert ecosystems," said Richard Symanski in his 1985 book *Wild Horses, Sacred Cows.*

Many rangelands were originally covered with a variety of bunch grasses, sagebrush, and other shrubs. But the land has been invaded by nonnative plants such as cheatgrass (*Bromus tectorum*), a Eurasian weed that outcompetes the native bunch grasses. Among the most damaging alien plants in the country, cheatgrass has invaded tens of millions of acres of western land.

Conventional wisdom holds that cows facilitate the growth of cheatgrass and other alien weeds by lacerating the soil surface with their sharp hooves, providing places for the cheatgrass to infiltrate the native bunch grasses. But conventional wisdom does not tell the whole story. "Cheatgrass can get a toehold without cattle," notes biologist Peter Brussard of the University of Nevada–Reno, citing the existence of cheatgrass in a lava-encircled tract of land, or kipuka, in Oregon. Because it's hard for cows to walk across lava, the kipuka is essentially a cow-free island of rangeland.

Regardless of how cheatgrass seeds infiltrate the stands of bunch grass, once introduced, cheatgrass takes over. The weed has two advantages over bunch grasses, which are slow-growing perennials that can live for decades: Cheatgrass grows faster and is an annual that completes its life cycle in a few weeks, producing a profusion of seeds that readily sprout the following spring. While cows facilitate the growth of cheatgrass by grazing, this same action stresses the bunch grasses. Each season that cows graze the land, more bunch grass clumps die, only to be replaced by cheatgrass seedlings.

Spanish were the finest horse breeders of the era and brought animals of the highest quality to the Americas. During the late 16th and early 17th centuries, some of these animals escaped and formed bands in the wild. Scientists estimate that by the middle of the 19th century wild horses numbered in the millions throughout the United States.

Compared to the long-legged, slender-necked horses used on today's ranches, these wild horses are sturdy-looking creatures. And, in fact, because American wild horses descended from domesticated animals that returned to the wild, it would be more accurate, if a great deal less popular, to call them feral horses.

In the 19th century, as settlers claimed more and more land for farming and grazing livestock, wild horses became restricted primarily to the less desirable, semiarid western rangelands. Today, most wild horses live in the high deserts (above 5,000 feet) of the Great Basin, which includes most of Nevada, as well as adjacent regions of Oregon, Idaho, Wyoming, Utah, and California. Smaller populations of wild horses live in Wyoming's Red Desert, and five other western states, as well as on Atlantic Ocean and Gulf of Mexico barrier islands. In addition, wild horses live on every continent except Antarctica.

Wild Horse Annie

Earlier this century, wild horses were exploited by ranchers and professional mustangers who sold them to the pet food industry and to rendering plants, which process carcasses into tallow, hides, fertilizer, and other products. The wild horse protection movement was born in 1950, when rancher Velma Johnston drove to her secretarial job in Reno, Nevada, behind a truck crammed with wounded mustangs, including some that had been blasted with buckshot and a colt that had been trampled to death. Appalled, she complained to the Bureau of Land Management (BLM), which administers most of the land where wild horses live, only to hear that the animals were considered pests that compete with cattle for precious forage and water.

Looking into the circumstances of wild horse capture, Johnston found that they were often hunted from trucks and airplanes, and wounded or chased until they collapsed. She devoted herself to ending

such inhumane treatment, earning the nickname "Wild Horse Annie." During the 1950s and '60s, she publicized the cruel fates of wild horses and her fear that the animals would be wiped out, prompting the public to deluge Congress with letters demanding protection for the horses. In 1970, the only issue that elicited more letters to Congress was the Vietnam War.

In 1971, Congress responded by declaring wild horses to be "living symbols of the historic and pioneer spirit of the West" that are part of our national heritage, and passed the Wild Free-roaming Horse and Burro Act. The act protects wild horses from harassment, capture, branding, and death. However, it also goes far beyond banning commercial exploitation, saying that wild horses "are to be considered...an integral part of the natural system of the public lands." Thus, the act essentially protects wild horses as if they were a native species.

"There's a real problem here," says biologist Robert Garrott of the University of Wisconsin. "Although I have no argument with the idea of maintaining free-roaming horses on federal lands, they are not native to the Great Basin ecosystem and their numbers must be closely managed. The level of protection that the law confers and the somewhat unrealistic expectations of the public are making it extremely difficult and expensive to manage horse numbers and maintain some sort of balance on our western rangelands."

Overgrazing the Range

Indeed, the effects of too many wild horses on rangelands are far from benign. While the horses prefer grasses, they will also eat bark, leaves, buds, fruit, and roots—in short, almost any part of a plant. "We have a legacy of more than 100 years of overgrazing in the West," says wild horse and burro specialist Thomas Pogacnik, who works in the Nevada office of the BLM. Overgrazing alters plant communities, which in turn alters animal communities. "When the horse population got too big in the Nellis Bombing Range [in Nevada], we lost antelope and ground squirrels. Badgers went down and coyotes went up. Now we've reduced the horse population and the other species are getting back into balance," he says.

In the worst cases, wild horses destroy

Wild horse management is an issue that stirs up strong emotions in the West and throughout the United States.

The preponderance of cheatgrass then leads to the demise of sagebrush and other rangeland plants. "Cheatgrass is green for about three weeks in the spring but dies in the summer. Unlike bunch grasses, cheatgrass carries fire easily, and sagebrush doesn't do well in fire," says Brussard.

Another consequence of cheatgrass's short life cycle is that the areas taken over by the weed no longer support the tremendous diversity of life usually found on rangelands. The dry, yellow cheatgrass stalks are a poor replacement for bunch grasses, which are green throughout their growing season and so support a tre-mendous diversity of life, providing everything from cover for jackrabbits to winter forage for pronghorn antelope. "Fifteen to twenty percent of the former Great Basin shrubland has been converted to cheatgrass barrens. It's not good for much of anything; it doesn't even support many cattle," says Brussard.

While there is no question that cattle have played a major role in damaging rangelands, they have not been the only culprits. "There have been great changes in the Great Basin, but how much you can lay at the feet of livestock is hard to dissect out," Brussard says. "Cattle, wild horses, alien weeds, and deer all came in at about the same time. Cattle probably facilitated the invasion of alien weeds, but so did people riding horses across the desert." In other words, while it's an important step, reducing the number of cattle will not be enough to save rangelands. According to Brussard, "If you want to see the Great Basin as it used to be, it'll take big restoration bucks and about 100 years."

Unfortunately, restoring rangelands will also take a lot of guesswork because no one knows exactly what they used to be like. "Cattle exclosures built in the 1940s are strikingly different from the areas around them. They're a tangle of vegetation," says Brussard. "But who knows if that's what was there?" The lesson drawn from western rangelands can be applied to different types of wild areas around the world: Because ecosystems are difficult or impossible to reconstruct, restoration is no substitute for preservation.

—*Robin Meadows*

Since wild horses became protected by law in 1971, their numbers have grown from 17,000 to at least 45,000, according to the Bureau of Land Management.

Contraception in Zoo Animals

Animals are born to breed, and, unlike their wild counterparts, those in zoos have plentiful food, expert health care, and a complete absence of predators. Therefore, for many species, managers must take care to avoid population explosions in zoos.

While zoos can give some of their surplus animals to other zoos, some animals are so common that they're hard to give away. Unwanted surplus animals can face overcrowding or worse. "Three to five years ago some zoos used to send excess hoofstock to ranches for big-game hunters," says Cheryl Asa of the St. Louis Zoo, who leads the American Zoo and Aquarium Association's (AZA) Contraception Advisory Group. "In the past, zoos didn't necessarily check to see where their hoofstock ended up. Now they do."

In part to limit the number of excess animals, zoos have turned to contraception. Other options for controlling animal births have major limitations. Sterilization has the drawback of keeping an animal from making future genetic contributions to the population. Separation of males and females means taking up valuable space that could be used to keep other animals, and is unnatural for many species. "Contraception permits zoos to manage animals while keeping them in social groups, which gives more natural displays," says Asa.

Birth control is used in hundreds of animal species. The most widely used method is a steroid hormone implant similar to Norplant, which is used by women. The implants used in zoo animals contain a synthetic progestin called MGA (melengestrol acetate). MGA implants have been used in big cats since the mid-1970s, in other carnivores and primates since the early 1980s, and in hoofstock during the last few years. However, the use of MGA has produced serious side effects in some species. For example, felids that have had MGA implants for four or more years have in some cases developed mammary tumors as well as uterine infections and tumors, leading the AZA to recommend removing the implants every two years for

vegetation and riparian zones, which contributes to desertification: soil erodes rapidly, groundwater levels sink, and topsoil and water become salty. "The Great Basin desert is a rapidly deteriorating environment," says Joel Berger, a University of Nevada–Reno, biologist who spent years studying wild horses in the Great Basin. "There is now a Great Basin National Park in eastern Nevada, but it's a tiny, dismal, token attempt," he says.

Wild horses account for up to one-third of grazing animals in the areas they inhabit, and, especially as the population grows, they are undeniably a threat to western rangelands. However, horses live on only a relatively small portion of rangelands and they account for only a small fraction of the total number of grazers in the West. Thus, when the issue of the ecosystem's health is raised, attention is quickly deflected to the other nonnative animals that graze western rangelands.

Much of the land in the West is publicly owned—more than 80 percent of Nevada is public land—and leased by ranchers who raise cattle and other domestic hoofstock. These domestic grazers have drastically changed rangelands over the course of the last century. In the 1800s, most of the hooved mammals in the Great Basin were bighorn sheep and pronghorn antelope, with a smattering of elk, bison, and deer. Today, the native ungulates are far outnumbered by domestic ungulates: In 1980, there were only about 5,000 bighorns, 6,000 pronghorns, and 80,000 mule deer versus about 30,000 wild horses, 270,000 domestic sheep and goats, and 310,000 cattle.

So far, cows have done far more damage to rangelands than horses have, says Berger. "Cattle have a huge impact relative to horses. Cattle have major negative effects on wetlands and riparian zones because they feed, rest, and defecate there. They cause loss of biodiversity," he says. "The effects of overgrazing by cattle are well documented." (See box, "Cows on the Range.")

As devastating as domestic grazers are to rangelands, however, Garrott points out that "we can control cows and sheep anytime we choose. But, if we don't check the growth of wild horse populations, then we'll get to the point that our ability to regulate their numbers will be overwhelmed."

An Overabundance of Horses

Besides benefiting the land, controlling the wild horse population will benefit the horses themselves. Like many other introduced species, wild horses are thriving in their adopted environment. Part of their success is due to their ability to subsist in habitats too marginal to support cows and other ruminants. Horses can live on diets that have a higher ratio of roughage to protein. Wild horses can also withstand extreme conditions: Winter temperatures in the northern Great Basin desert drop as low as -40°F and summer temperatures in Death Valley shoot as high as 110°F.

Another reason for the wild horses' success is their fecundity. Mares can foal at two years and are fertile for the rest of their lives, which can span up to 25 years. Most western populations grow by 15 to 20 percent a year, which means that without intervention the population will double in four to five years. Because these animals have no significant predators, uncontrolled populations increase until the horses need more forage than their environment can provide, and then huge numbers starve to death. "We had thousands die in Nevada last winter," says Pogacnik. The message is clear: If we fail to control wild horse populations, nature will.

During the more than 20 years of protection, wild horses have increased in number from an estimated 17,000 in 1971, to about 45,000 in 1992, according to BLM estimates. Some wild horse experts believe the current population is even larger. "There are probably closer to 60,000, and most populations are still increasing," says Garrott. But, while the experts disagree about exactly how many wild horses there are, almost everyone agrees that there are too many.

There is no consensus, however, on the best way to control the wild horse population. The Bureau of Land Management stands by its current method of removing wild horses from the range and giving them new homes through the Adopt-A-Horse Program. "The only way we have of getting them off the range is getting them adopted," Pogacnik says. However, most people want to adopt young horses with good conformation, and horses that cannot be placed must be maintained indefinitely on feedlots. "In 1984-85, we removed 13,000 horses but could only adopt 4,000.

In recent years, an uncontrolled population of wild horses has led to thousands of the animals starving to death.

several natural cycles. And, as Asa points out, there is no single contraceptive method that is effective for all animal species. MGA, for instance, simply doesn't work in equids (horses, zebras, and asses).

Immunocontraception, which involves injecting females with a protein extract from pig eggs (PZP, or porcine zona pellucida) that keeps sperm from binding to eggs, has the advantage of working in many species. Researchers have shown that PZP reduces fertility in several species of primates and in 12 species of hooved mammals in zoos.

Although effective, PZP is not perfect either. "PZP is an interim measure until we get something better," cautions Asa. "It's a very crude preparation [containing many proteins that can elicit immune responses] and there are [presumably autoimmune] reactions in the ovary that can lead to sterility as a long-term effect." While the long-term effects in hoofstock have not been studied, PZP has been known to cause generalized ovarian damage and sterility in dogs and primates.

Some potentially safer animal birth control methods are in the works. One promising method involves injecting silicone into the male's vasa deferentia, the ducts that carry sperm from the testes to the penis. These "vas plugs," according to Asa, "are working well in a large size-range of species: the bobcat may be the lower limit." Scientists are currently testing ways to make the effect of the plugs reversible.

Bisdiamines are another promising male contraceptive. Originally developed for use in men, these nitrogen-containing compounds reversibly inhibit sperm production without blocking testosterone production. Because they also inhibit alcohol dehydrogenase, the enzyme that detoxifies ingested alcohol, bisdiamines have been withdrawn from human clinical trials. However, this side effect presents no problem for abstinent zoo animals!

—Robin Meadows

Most wild horses live in the high deserts of the Great Basin.

This is unfair to the [rest of the] animals and is extremely expensive," says Pogacnik.

Altogether, removal, adoption, and maintenance in feedlots use up two-thirds of the $14 million earmarked annually for managing wild horses and burros. "The program is expensive per animal managed because the public is very demanding about how we manage them," says Pogacnik. "It is not a logical program. It is emotional."

Thus far, however, removal has not been enough to control the wild horse population. While Pogacnik maintains that removing 5,000 to 6,000 horses a year will bring the wild population down to the BLM's target level of 30,000, Garrott disagrees. "BLM has spent over $150 million during the past two decades removing 133,000 wild horses from rangelands—an average of about 6,000 a year—yet the number of horses on federal lands has tripled [since the animals were first protected in 1971]. Clearly, the Adopt-A-Horse Program is not enough," he says. "I do think the problem is solvable, but we need to implement additional management programs in order to succeed."

Equine Birth Control

Garrott favors a combination of removal and birth control, which the BLM has been studying in wild horses since the early 1980s. The BLM first considered but ultimately rejected birth control in dominant stallions. Among the reasons given for this is that larger bands of horses have more than one stallion, and the subordinate stallions sire a third of the foals. Moreover, mares that fail to get pregnant during the spring can become fertile every three weeks for most of the rest of the year, and thus could conceive out of season. Foals conceived out of season would be born out of season, and those born during the winter would probably die due to the freezing temperatures and lack of food.

The Bureau of Land Management then turned to investigating birth control in mares. From 1985 to 1990, the BLM funded a study of steroid hormone implants by Garrott and his colleagues. They implanted mares with the steroid hormone ethinylestradiol (an ovulation inhibitor used in birth control pills for women) and found that the treatment reduced the percent of mares that foaled from the normal 50 percent to 10 percent. Garrott and his

colleagues also found that the implants were effective for three to five years and cost only about $100 each.

Despite the effectiveness of steroid implants, the BLM abandoned this research in 1990 when the agency determined that the public was against the method. "We dropped using steroids because the public didn't like the invasive procedure of getting a large solid substance into an animal," says Pogacnik. "Public perception is very important in this program. There are things that we could do in deer and other kinds of wildlife, but if we proposed to do them in horses it would create a national stir. The horse has a mystique that towers over that of any other wild species in this country."

Be that as it may, public opinion is not always the best guide. And, perhaps public opinion of wild horse management might be changed if more attention were paid to education than to emotion. "It only takes ten minutes to implant steroids," says Donald Siniff of the University of Minnesota, one of Garrott's colleagues on the steroid implant study. "It's a lot easier on horses than capturing [and putting them up for adoption]."

The Bureau of Land Management has considered several methods of contraception for wild horses, but has yet to implement any of the plans on a large scale.

"A Shot in the Rump"

The BLM is now focusing its birth control research efforts on a study of immunocontraception by Jay Kirkpatrick of the Deaconess Research Institute, in Billings, Montana, and his colleagues. "The public prefers immunocontraception—it's just a shot in the rump," says Pogacnik. Immunocontraception involves injecting mares with PZP, a protein extract of the outer layer of pig eggs. (The outer layer of mammalian eggs is called the zona pellucida; PZP stands for porcine zona pellucida.) A mare injected with PZP produces antibodies against the foreign pig proteins. These antibodies also bind the proteins in the outer layer of her own eggs, thereby blocking sperm from fertilizing them.

Like steroid implants, PZP injections are highly effective at reducing birth rates in mares. However, PZP must be reinjected yearly, making the method most promising for controlling populations of readily accessible horses such as those on Assateague Island and other barrier islands. PZP may also be useful for controlling populations of captive animals. (See box, "Contraception in Zoo Animals.")

In contrast, PZP has limited applications for most populations of wild horses in the West. In some areas, more than a thousand wild horses roam over thousands of acres of wooded, mountainous terrain, making yearly injections extremely difficult. "It's fraught with problems," says Siniff. "You can't always tell males from females from the air, and when you're flying, hanging out the door, you're not always sure who you hit."

While neither steroid implant nor PZP is perfect, these birth control methods are better than nothing, says Garrott. "You can always put off making the decision to implement contraceptive programs while waiting for the perfect technology. As we continue studying contraceptive agents and applications, however, horse populations continue to increase," he says. "We need to get horse numbers down to a manageable level before the sheer number of animals overwhelms our economic resources and surpasses the capabilities of our limited tools for population management. The heavy winter die-off due to starvation last year has given us a reprieve, but I think we are getting dangerously close to the point where numbers will become unmanageable." Garrott cautions that "Australia has something like 300,000 wild horses and they've simply given up. Now they just shoot them."

America's love affair with the wild horse notwithstanding, we may have to choose to some extent between the horses—and livestock—and the health of the land. The problem is that too few people are as passionate about the soil and grasses that are the basis for the great diversity of life on the range as they are about wild horses. Berger points out that unless we are satisfied with artificial environments shaped by introduced species, we must control the species that are not native to our land. We should take his advice before western rangelands have deteriorated so far that there's nothing left to preserve.

Robin Meadows is a contributing editor to ZooGoer.

A Modern-day Prairie Tale

"I was born upon the prairie, where the wind blew free and there was nothing to break the light of the sun. I was born where there were no enclosures and where everything drew a free breath. I want to die there and not within walls."

Parr-Wa-Samen, also known as Ten Bears, of the Comanches.

Tall-grass prairies once stretched over 150 million acres of North America's heartland. From Manitoba to Texas, a billowing expanse of prairie grasses and wildflowers swept across an open, virtually treeless landscape. Buffalo roamed freely. Prairie chickens performed elaborate courtship dances. Bobcats, golden eagles, and jackrabbits flourished. Now, most of the prairies are gone, their thick sods broken and plowed under to make way for corn and wheat. The widespread destruction of the prairies brought many animals and plants that inhabit them to the brink of extinction.

Remarkably, thanks primarily to the efforts of nonprofit groups in Canada and the United States, tall-grass prairies are making a comeback, one plot at a time. From a 100-acre cornfield in northern Illinois to a 30,000-acre cattle ranch in northeastern Oklahoma, prairies—complete with prairie chickens, bobcats, songbirds, and, yes, even buffalo—are being reconstructed from scratch.

A Land of Grasses and Forbs

Three main types of prairie defined the grasslands—tall, short, and mixed—their ranges determined primarily by rainfall. Tall-grass prairie was the most productive. It flourished in the eastern grasslands where rain was plentiful. From westernmost Indiana to central Nebraska, three tall grasses predominated: big blue stem and Indian grass, both of which can reach nine feet in height, and the slightly shorter switch

David Salvesen
Photographs by Harvey Payne

Western diamondback rattlesnake.

Overleaf: A white-tailed deer fawn nestles among flowers and tall grasses on the Oklahoma prairie.

grass. Early European settlers told of how the tall grasses grew high enough to be tied together over the backs of their horses.

In between the moist prairies to the east and the dry plains to the west occurred a transition zone known as the mixed-grass prairie, where tall grasses yielded to the hardier and more drought-resistant mixed grasses, such as little blue stem, which was the most abundant, and needlegrass, June grass, and western wheat grass. All reached heights of two to four feet.

Growing among these grasses was a panoply of brightly colored forbs with whimsical names like shooting star, rattlesnake master, and compass plant, so named because of the north–south orientation of its leaves.

Farther west, spreading across the dry plains from west Texas and western North Dakota to the foothills of the Rocky Mountains, the short grasses held sway. Gamma grass and curly leaf buffalo grass occupied much of the drier plains.

Prairie grasses grow and die back annually. Like bears sleeping through long, difficult winters, prairie plants shut down in the fall. The grasses lie dormant, their deep, extensive, and perennial roots guaranteeing their timely return with the arrival of spring. In his recent book, *Tallgrass Prairie*, John Madson writes of the prairies, "No other community vanishes more completely in the fall. None returns more richly with the fine days of spring."

Nor more vigorously following fires. Known as the "red buffalo" to the Plains Indians, fire is a critical part of prairie ecology. Far from damaging the prairies, fires rid the rolling grasses of invasive trees and weeds, unlocking many of the minerals stored in the stems. And, with their deep roots tucked safely below ground, the grasses sprout anew after a fire. The lush new growth is attractive to buffalo and other grazers.

The Richest Soils on Earth

The soils of the former tall-grass prairies are among the richest on earth. The same soils that produced eight- and nine-foot-tall grasses also produced record yields of wheat and corn. Their richness probably hastened the downfall of the prairies, as settlers earnestly converted the heavy sods to cropland.

More than 99 percent of the original prairie has been destroyed. Illinois, the "Prairie State," lost an estimated 99.9 percent of its prairies. Other states in the Midwest suffered similar losses, virtually all due to conversion to agriculture. Most of what remains—about 300,000 acres—is preserved in national parks and grasslands such as Theodore Roosevelt National Park in North Dakota, Buffalo Gap National Grassland in South Dakota, and Oglala National Grassland in Nebraska.

The prairies were largely obliterated by the beginning of the 20th century. Gone were the endless waves of big and little blue stem, Indian grass, and switch grass. Gone were the carpets of flowers that colored the prairies in summer. And, gone too were the mighty

From a low of fewer than 1,000 animals at the turn of the century, North America's bison population has grown to an estimated 150,000 today.

herds of buffalo that had sustained the Plains Indians for centuries.

Somewhere between 20 and 60 million buffalo once roamed the Great Plains. Then came European settlers with their plows, long-range rifles, and markets hungry for buffalo hides. In the mid- to late-19th century, professional buffalo killers slaughtered buffalo by the millions. One set a record by shooting 120 of the burly beasts in 40 minutes.

By the turn of the century, fewer than 1,000 buffalo remained. But, unlike the Indians, who killed the animals primarily for food, clothing, and shelter, the bounty hunters were interested only in the hides; most of the meat simply rotted in the field. As the buffalo faded into obscurity, so too did the Plains Indians who depended on them. "The Plains Indian not only ate buffalo, but buffalo largely determined his architecture, dress, language, arts, and religion," wrote Aldo Leopold in his *Round River* essays, published in 1953.

Known scientifically as *Bison bison*, but more commonly called buffalo, some 150,000 of these bovids live in North America today, according to the American Bison Association, of Denver, which boasts more than 1,400 members hailing from all 50 states and a dozen countries. Most buffalo reside on private lands. The largest private herd belongs to media mogul Ted Turner, who grazes about 5,000 head on five ranches. The largest public herd is probably in Yellowstone National Park, where some 25,000 to 30,000 buffalo live rather tenuously: Those that leave the park are shot.

Despite the near total annihilation of the prairies, remnants can be found along railroad rights of way, in pioneer cemeteries, and in other out of the way places that were spared the plow. Some pieces were preserved by quirks of geology in areas where exposed bedrock or rocky soils rendered the land unfit for plowing.

A 4,000-acre tall-grass prairie in Argyle, Manitoba, was preserved by the area's peculiar geology. The property lies in the glacially scoured Red River Valley, which extends from Minnesota and North Dakota to Lake Winnipeg in Manitoba. Boulders and gravel left behind by a retreating glacier made farming difficult if not impossible. Even today, the ground is hard to break. In 1989, the Manitoba Naturalist Society purchased the prairie to preserve it, and later opened a nursery, called Prairie Habitats Nursery, to conduct research on tall-grass prairie restoration.

In the United States, some of the largest remaining prairies can be found in the Flint Hills, a ridge of shallow soils underlain by flinty limestone that runs north–south from southeastern Nebraska, through eastern Kansas, to northeastern Oklahoma. The 8,600-acre Konza Prairie, outside Manhattan, Kansas, owes its survival to these hills. Although grazed in the past, the prairie was never plowed. "Konza was one of the preeminent grazing lands," says Alan Pollom, state director for The Nature Conservancy, in Kansas.

The Conservancy owns the prairie, which is managed as a research site by Kansas State University. According to Pollom, "Scientists from all over the world

Overleaf: A view of The Nature Conservancy's tall-grass prairie preserve in Osage County, Oklahoma.

Nesting killdeer on the tall-grass prairie.

Overleaf: Tall-grass prairies once stretched over 150 million acres of North America's heartland.

come to Konza to conduct research." About 160 buffalo roam Konza, at least up to the fenceline. "The property borders Interstate 70, so we can't let them roam too far," explains Pollom.

Building Prairies from Scratch

The first prairie restoration took place in the 1930s at the University of Wisconsin Arboretum, in Madison. "They were ahead of their time," remarks Daryl Smith, biology professor and prairie maven at the University of Northern Iowa, in Cedar Falls. Led by Aldo Leopold, one of the fathers of America's conservation movement, who served briefly as its director, the Arboretum sought to create a microcosm of Wisconsin landscapes.

Leopold arranged for workers from the Civilian Conservation Corps to collect seeds and plants from small pockets of prairie in the region and transplant them at the Arboretum. Initially, the transplanted prairie would not take. Weeds repeatedly invaded the site and crowded out native plants. A few years later, a botanist named John Curtis began to experiment with using fire to control weeds and stimulate the growth of the prairie grasses. It worked. Today, controlled burning has become the most important prairie management tool.

According to Smith, prairie restoration really didn't begin to catch on until the 1970s. Since then, however, interest has grown rapidly. Why? "Nostalgia, plus a sense that we've lost much of our natural heritage," reasons Smith, who teaches a course on the mystique of the prairies. He finds a certain irony in the growing interest in saving prairies. "We've done all these nasty things to the prairies, yet we retain this nostalgia about them."

One of the largest prairie restorations is underway in Oklahoma, at the southern terminus of the Flint Hills. In Osage County, near the northeastern Oklahoma town of Pawhuska, The Nature Conservancy is trying to create a tall-grass prairie preserve out of a 30,000-acre ranch. The ranch has never been plowed, and the essence of the original grassland, although somewhat altered and degraded, is intact. "We still have much of the original complement of plants and animals," boasts Bob Hamilton, director of science and stewardship at the Conservancy's preserve, adding, "we've already catalogued over 500 species of plants on the preserve."

The Conservancy purchased the property in 1989 and began tearing out miles of fences that broke the site into numerous parcels. In 1990, ranching ceased, and last year 300 buffalo were released on the property. The Conservancy hopes the herd eventually reaches 1,800 strong. One of the Conservancy's goals is to restore the original fire-induced rotational system characteristic of prairies, whereby fire sweeps through the prairie, and soon thereafter buffalo abandon unburned areas in favor of the lush regrowth that sprouts after the fire. Dead grass then accumulates in the unburned areas, making them more susceptible to fire. The result

is a shifting patchwork of burned and unburned areas, or what Hamilton calls a "dynamic landscape patch mosaic." Last year, the Conservancy set fire to more than 20,000 acres. When it's finally restored, the preserve will be the largest tall-grass prairie in North America.

The U.S. Fish & Wildlife Service (USFWS) is also trying its hand at a large-scale tall-grass prairie restoration at the Walnut Creek National Wildlife Refuge, located appropriately in Prairie City, Iowa. Unlike the situation at the Conservancy's ranch in Oklahoma, however, where many of the prairie plants are still present, the USFWS has had to start from scratch at Walnut Creek. Farming on the 8,600-acre property had completely obliterated any remains of the original prairie. Using seeds gathered from 38 counties in Iowa, the USFWS has planted a few hundred acres of prairie, starting with 80 acres in 1992. The plan is eventually to convert the entire property to prairie by planting about 400 acres each year.

Buffalo and elk will be shipped in from herds in the Niobrara National Wildlife Refuge in Valentine, Nebraska. As in other preserves, the buffalo will be fenced in; the refuge is not big enough to let them roam freely. "Bison tend to migrate over large distances. Obviously, we can't allow that," remarks Richard Berger, manager at Walnut Creek.

Education is one of the main missions of the refuge. "Most people out here don't realize that corn and soybeans are not the native landscape in Iowa," observes Berger. Unlike the Tetons or the Grand Canyon, the prairie's beauty is subtle. "The prairie needs to have itself interpreted," continues Berger. "That's what we're trying to do."

Interestingly, in the mid-1970s the Walnut Creek land was purchased by the Iowa Power Company as the site of a planned nuclear power plant. Later, the company scrapped plans for the plant and leased the land to local farmers before selling it to the Fish & Wildlife Service.

A prairie, however, is more than just a collection of native grasses and flowers grown in a former cornfield. As John Madson writes in *Tallgrass Prairie*, "a real tallgrass prairie is a system defined by climate, weather, size, and the interaction of fire and grazing bison." Yet, like the work done at the Wisconsin Arboretum, prairie restoration efforts add to our collective knowledge and appreciation of prairies and provide additional habitat for animals that have been squeezed into shrinking and isolated remnants of a once-dominant landscape.

A Buffalo Commons?

The most ambitious, radical, and contentious prairie restoration proposal calls for returning about one-fourth of the land of the Plains states to prairies to create what has been called a "Buffalo Commons." According to this scheme, made famous by the husband and wife academic team of Frank and Deborah Popper of Rutgers University, an enormous ecological and historical preserve would be created out of the most economically depressed and depopulated sections of the Plains states. The Poppers believe that these areas, plagued with drying aquifers, aging populations, and continued environmental degradation, probably should never have been developed in the first place.

The preserve would encompass much of western North and South Dakota, western Nebraska, big chunks of Kansas, Oklahoma, and Texas, as well as parts of Wyoming, Colorado, and New Mexico. It would include places like Hayes County, Nebraska, roughly two-thirds the size of Rhode Island but with a population of only about 1,200 people.

The proud people of the region have not taken the Poppers' vision lightly. As the bearers of a threat to a whole way of life, the couple has been dismissed, disdained, reviled, and even threatened throughout the Midwest and West. Yet, the Buffalo Commons is not an entirely new concept. In Durward Allen's classic 1967 book, *The Life of Prairies and Plains*, he discusses "setting aside and restoring a large grassland park, perhaps a million acres, where conditions would be as primitive as possible, where large herds of buffalo would roam and live in an environment much like that of the time before Columbus."

More than 40 years ago, Aldo Leopold solemnly wrote that "No living man will see again the long-grass prairie, where a sea of prairie flowers lapped at the stirrups of the pioneer. We shall do well to find a 40 [acre plot] here and there on which the prairie plants can be kept alive as species." Rather than settle for a few prairie museum pieces here and there, the prairie restorations underway may someday result in the creation of large, functioning prairie ecosystems for everyone to see and enjoy, buffalo and all.

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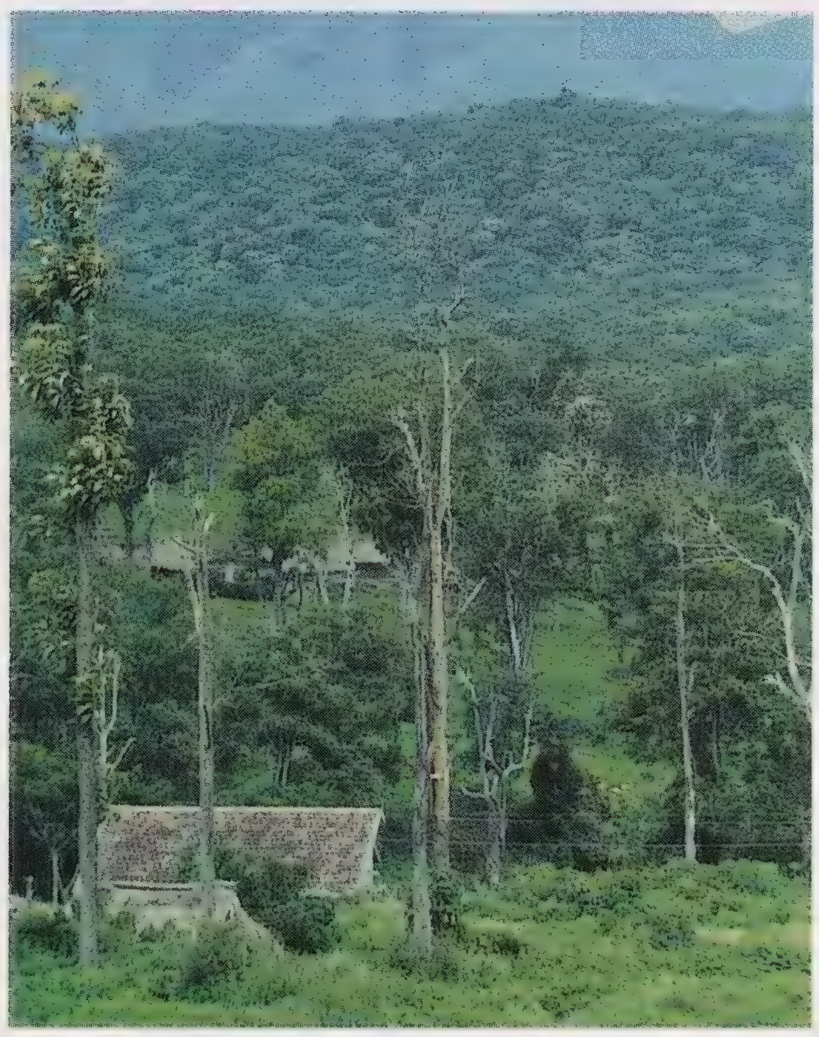
Prairie Tales at the Zoo

Never seen a prairie? Then wait a few years, and you won't have to leave Washington to see one. Planning is underway for a Grasslands Exhibit at the Zoo, complete with a North American prairie, an East African savanna, and an Australian grassland, along with various animals native to each of these ecosystems. Look for details in future issues of *ZooGoer*.

Songs of India's South Hills

Raucous calls. Fluttering wings and flashes of color. Concentric circles spread as tiny feet probe the water. Dusk was settling over the Indira Gandhi Wildlife Sanctuary in southwest India, and Kannan, a University of Arkansas ornithologist, my friend Raghavan, and I were awestruck by the procession of birds that bathed and drank before us in a shallow stream running through moist deciduous forest.

No pigeons or crows here: It was as if the birds we saw had been drawn from a select guest list of unusual species. A babbling flock of about a dozen robin-sized Wynaad laughing thrushes were the first to show. These birds usually hide deep in foliage, but in the waning light they boldly dropped into the middle of the shallow stream and started bathing vigorously.



(Howard Youth)

A minute later, Kannan turned to us and pointed to the bank in front of the laughing thrushes. "That's an Indian blue chat!" he whispered enthusiastically. "I've looked for this bird for the past two years and haven't had any luck until now." The small blue-backed bird with the white brow and buffy orange breast drank from the stream's edge. Soon it would be winging its way north toward its breeding grounds in the Himalaya.

The chat disappeared, replaced by a pair of blue-throated flycatchers, also wintering Himalayan birds about to head north. A white-throated ground thrush, a subspecies unique to south India, dropped into the shallows next. Then, spotted babblers appeared, followed by black-headed babblers. The stream had become dotted with colorful forest birds.

It was no accident that Raghavan, Kannan, and I, all ardent birdwatchers, had wound up at the Indira Gandhi Wildlife Sanctuary. This is major-league birding territory. The sanctuary sits nestled in the Anamalai Hills, a southern extension of the spine of mountains called the Western Ghats, which lie along India's west coast from just north of

Howard Youth

Black-backed woodpecker.
(Howard Youth)

Bombay to nearly the country's southern tip. The Western Ghats form a last refuge for many species of plants and animals, as the combined forces of nature and humanity have turned these mountains into islands amidst a sea of dusty plains.

Although India boasts over 1,200 bird species, its birdlife is richest in the moist hill forests of two regions: the Himalayan foothills, and, far to the south, the isolated Western Ghats, where we sat watching the birds bathe. The Ghats wring moisture from clouds that sail in from the west.

The increased humidity keeps the hills strikingly different biologically from the surrounding flatlands. The wetter western slopes hold rich, moist evergreen forests festooned in lianas, with rattan cane and a wide variety of tree species including cinnamon, nutmeg, and jackfruit. The drier eastern hills, dominated by large clumps of bamboo and wild teak, harbor a different birdlife than the moister forests. At higher altitudes (some of the peaks of the Western Ghats reach about 7,000 feet; the highest is 8,841 feet), sholas, or patches of evergreen forest, intersperse with rich grassland.

These cloudy hills are home to more than a dozen bird species endemic, or unique, to this mountain paradise. Flocks of blue-winged parakeets streak over the canopy, while small sunbirds sing from atop rainforest trees next to hooting crimson-throated barbets. White-bellied treepies and Malabar grey hornbills pick fruits from these same trees.

Tiger bittern and young.
(P.K. Uthaman)

Crested serpent eagle.
(P.K. Uthaman)

Observing Evolution's Effects

You can watch evolution in action in places like the Western Ghats. The list of bird subspecies unique to these hills is long, and these birds, breeding separately from others of their species, have in many cases developed different plumages. The black-headed babblers we watched in the stream, for instance, have heads that are completely black. Black-headed babblers in nearby Sri Lanka have evolved different head markings, with the black limited to the forehead and feathers around the ear, and brown on the rest of the head. These populations do not mingle, and ornithologists will probably classify them as separate species in the near future.

The year-round, or resident, birds of the Western Ghats are victims of physical isolation. In many cases, these nonmigratory species have become sequestered from others of their kind. For example, India boasts three separate subspecies of the hill myna, a bird famed for its ability to imitate human voices. Each subspecies is widely separated from the others: one is common in the moister forests of the Western Ghats and in Sri Lanka; another occurs in the hills of the eastern state of Orissa; the third subspecies inhabits the dense forests at the base of the Himalaya in northeast India, Bhutan, and Nepal.

Great pied hornbill.
(Shekhar Dattatri)

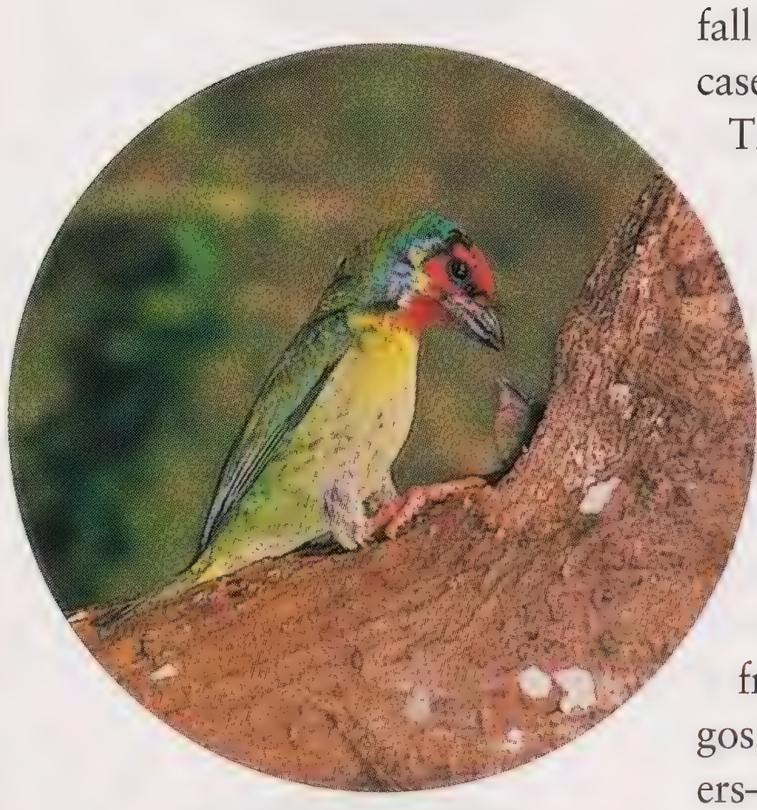
Crested serpent eagle.
(P.K. Uthaman)

What happened to segregate these populations? Scientists think that Western Ghats birds once shared much larger ranges with their now-distant northern relatives. Over time, however, weather patterns in India have changed. A slow drying out of much of the subcontinent, combined with the erosion of hills, has whittled away the habitats, and therefore the ranges, of many species. The Western Ghats remain as rare pockets of humidity where lush plant growth flourishes above the dusty plains.

In this scenario, heavy-flighted birds such as laughing thrushes, which could not migrate long distances, were simply left behind to evolve into separate species and subspecies as their ranges melted into fragments. Indeed, today India's laughing thrushes are a fractured family: two endemic species and one endemic subspecies live in the Western Ghats, nearly two dozen species inhabit the Himalayan foothills, and one species lives in the forests of Sri Lanka. "The Himalayan and South Indian communities of laughing thrushes," wrote the late dean of Indian ornithologists Salim Ali, "do strongly suggest that they are relic colonies of a once continuous population."

Nilgiri wood pigeon.
(P.K. Uthaman)

But not all birds are trapped in the mountains. Long-distance migrants stream in from the north each fall to spend half the year in the Western Ghats. In some cases, it's not easy to distinguish visitors from residents: The tiger bittern, for example, nests in the Western Ghats, but its population is bolstered half the year when the east Indian population of these forest-loving herons disperses and flies southwest to winter. Ornithologists still have a long way to go in untangling all the mysteries of bird population dynamics in the Western Ghats.



Crimson-throated barbet.
(P.K. Uthaman)

Plant and invertebrate diversity is also incredibly high in the Western Ghats, and the bounty of fruits and insects keeps large flocks of birds busy. A fruiting ficus tree will pulse with birds—barbets, drongos, mynas, hornbills, woodpeckers, bulbuls, and others—for the few days its fruit remains ripe. The birds, like merry partygoers, follow each other from one fruiting tree to the next, scattering seeds throughout the forest via their droppings along the way.

The feeding frenzies, in turn, attract other diners. More than 20 species of hawks, eagles, and falcons inhabit the hill forests, and small-bird specialists like the crested goshawk, shikra, and besra sparrowhawk often zoom in to break up congrega-tions of fruit-eating birds, reaping secondary benefits from the ripe trees.

Blue-bearded bee-eater.
(P.K. Uthaman)

The Good News and the Bad

The Western Ghats will likely remain a slowly changing, biologically diverse region for centuries to come. But, the future of this special area is also threatened by India's growing human population, as expanding villages un-

Indian great black woodpecker.
(P.K. Uthaman)

leash more timber cutters, poachers, and herds of cattle and goats into the forest. A glimpse at the Eastern Ghats, a drier and lower hill range along India's southeast coast, provides a view of what could happen in the western hills. Government forest reserves in the Eastern Ghats have been overwhelmed by farms, villages, and eucalyptus groves that provide virtually no wildlife habitat. Today, many plant and animal species are gone, and in most parts of the Eastern Ghats only small fragments of the original forest cover remain.

Despite the fact that large-scale habitat destruction in the Western Ghats began during the British occupation in the 1700s and continues today, large stretches of forest remain there, although many have become sandwiched between thousands of acres planted in teak, tea, coffee, and cardamom. Over the past few decades hydroelectric plants have sprung up, and their associated dams and reservoirs have submerged thousands more acres.

Fortunately, not all human activity in the Western Ghats is detrimental to the region's unique birds and other wildlife. Coffee plantations provide very good secondary habitat. Growers shade their young coffee plants from direct sunlight by leaving in or planting taller canopy species. The resulting two-tiered, managed "forests" are far more productive for wildlife than the comparatively sterile tea and teak plantations, although they are still no match for natural habitat.

Greater racquet-tailed drongo
(P.K. Uthaman)

Other good news is that large contiguous patches of the Western Ghats are protected as parks and sanctuaries. For example, the Indira Gandhi Wildlife Sanctuary in the state of Tamil Nadu is joined with the Parambikulam Wildlife Sanctuary in adjacent Kerala to form a 304,000-acre wilderness. This area protects not only endemic and wintering birds but also some of the region's endemic mammals, including the Nilgiri tahr, a relative of sheep, and two monkeys, the Nilgiri langur and the lion-tailed macaque.

Black-nested swiftlet.
(P.K. Uthaman)

To the north, three parks—Bandipur National Park in Karnataka, Mudumalai Wildlife Sanctuary in Tamil Nadu, and Wynad Wildlife Sanctuary in Kerala—join to cover another 334,080 acres of deciduous and evergreen forests. These large tracts of land provide wide areas of prime nesting habitat for many of the region's birds, and also afford southern India's increasingly stressed elephant herds breathing room. The south's sparse tiger population also finds refuge here.

Altogether, the parks in the states embracing the Western Ghats—Maharashtra, Karnataka, Kerala, and western Tamil Nadu—protect, at least on paper, about 1.8 million acres, an area nearly as large as Delaware and Rhode Island combined. Unfortunately, most of the region's 20 or so sanctuaries and parks are scattered.

Hill myna.
(P.K. Uthaman)

Yellow-browed bulbul. (P.K. Uthaman)

And mismanagement is a big problem: Timber cutters (including those poaching the aromatic sandalwood tree) and livestock work their way across park boundaries, while illegal hunters come and go.

The Great Pied Hornbill's Story

The health of an area's bird populations is often a useful indicator of the overall health of an ecosystem. In the Western Ghats perhaps the best "indicator species" reflecting the health of the region's moist evergreen forests is the massive great pied hornbill. The size of a turkey vulture, this predominantly fruit-eating bird requires large areas of undisturbed habitat with at least a scattering of ancient, towering trees, within which it raises its young.

The first in-depth study of the far-flung Western Ghats subspecies of this bird (other subspecies occur in small numbers from the Himalayan foothills to southwest China and down to the Indonesian island of Sumatra) is being carried out by Kannan. He estimates that throughout the Western Ghats only 100 or so fragmented forests provide habitat for hornbills. Virtually all of these sites survive because they either lie on slopes too steep for farming or fall within park boundaries.

But poorly monitored parkland affords no protection in many places, such as in Kerala where Kannan has found pillaged nests and large stretches of prime habitat without hornbills in areas where people consider hornbill flesh a delicacy. The decline of these fruit-dispersing birds, which are among the only species large and strong enough to crack nutmeg and other seeds, undoubtedly affects the forest's integrity.

Although a healthy number of parks and sanctuaries have been set aside, the biggest challenge will be to properly manage and protect them as the populations of people and livestock living around the parks continue to grow. Proper planning and conviction on the part of India's central and state governments are needed to ensure that the Western Ghats will not go the way of their eastern cousins. Ultimately, however, the size of the region's human population will have the biggest effect on the future of the Ghats and the birds living there.

For now, the future still looks bright. There remain places where you can sit atop a rise and see nothing but forest spreading across the hilly horizon. And, hidden away in this wilderness, waiting to be discovered, are secluded streams filled with exotic, bathing birds.

Former World Watch *assistant editor Howard Youth is freelancing from his temporary home in Madras, India.*

Rufous babbler. (P.K. Uthaman)

Yellow-cheeked tit. (P.K. Uthaman)

White-throated ground thrush and young. (P.K. Uthaman)

The Right Bluff

Mary Batten

More than a century ago, Charles Darwin urged his readers "never to forget that every single organic being may be said to be striving to the utmost to increase in numbers." That goes for beetles, butterflies, white-tailed deer, chimpanzees, humans—every living thing. From a biological standpoint, reproduction is the name of the game and sex is one of the most elaborate, energy-intensive, and, yes, pleasurable means that ever evolved for getting the job done.

We humans have no monopoly on courtship and mating. In fact, our rituals for getting boy and girl together seem distinctly pedestrian when compared to the strategies of nonhuman species, whose bizarre cast of characters includes cannibals, transvestites, hermaphrodites, males with two penises, and plants that deceive, seduce, and kill. When it comes to mixing genes—and biologically, that's what sex is all about—anything and everything goes. There are no "unnatural acts" in nature.

For example, contrary to our neat moralistic fables, evolution often favors the trickster. The individual who can successfully put one over on his or her rivals usually wins out. (In the biological view of things, winning means leaving more offspring.)

Consider the scorpionfly (*Hylobittacus apicalis*), which ranges throughout much of the southern Appalachians and into Illinois, Ohio, and southern Michigan. Courtship etiquette among this species, which is also known as the hangingfly, demands that the male hunt down a large, tasty prey insect and present it to a female. Although he risks his life by exposing himself to predators such as spiders as he hunts, he's sure to die a virgin if he has no nuptial gift to attract a mate.

When he finally selects a prey insect, he kills it by driving his sharp proboscis into his victim's body. He then releases enzymes that liquefy the insect's body contents so they can be sucked out by a female scorpionfly. He also releases a pheromone, a chemical that acts as a sort of perfume to attract females from as far as 42 feet away.

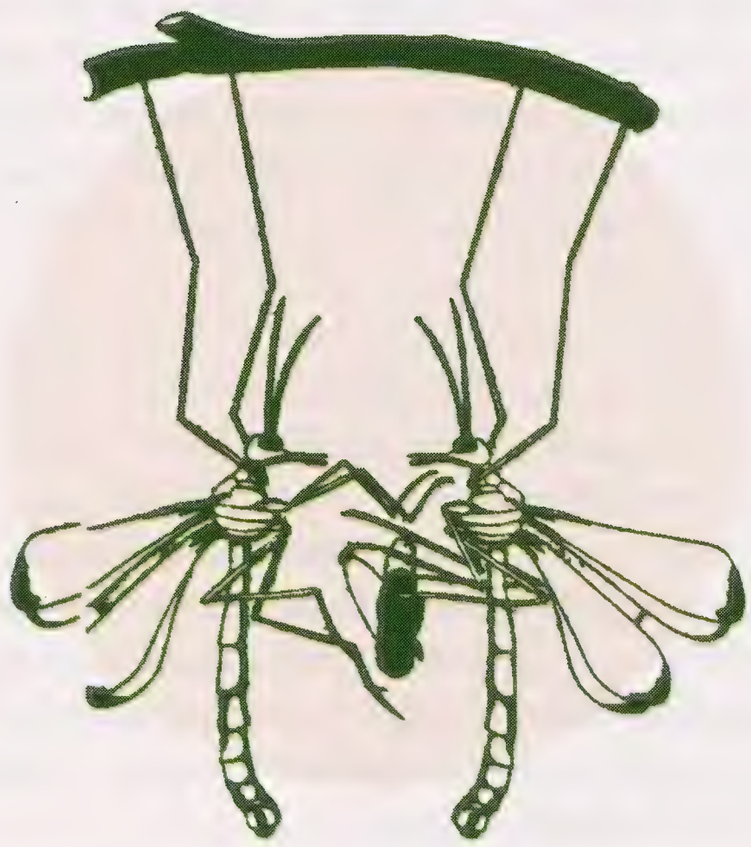


Illustration: Alan Bliss

Hanging from a twig by his front legs, with his nuptial gift grasped in his hind legs, the male scorpionfly waits for a female to accept him. Any interested female examines the prey insect and tastes it. All the while, the male tries to mate, but the female—like females of most species—is very particular and takes her time making her choice. Not any old nuptial gift will do.

Biologist Randy Thornhill of the University of New Mexico–Albuquerque has discovered that the male's gift must be at least a quarter-inch square to be accepted by a female. She will reject any male whose gift is too small. Because the female will copulate only so long as she's eating, fast food is definitely not to the male's advantage. It takes more than five minutes for the male to transfer enough sperm to fertilize the female's eggs.

A large gift can buy 20 minutes or more of copulation. Her appetite satisfied, the female becomes unreceptive to other males and begins laying eggs. If the male's gift is large enough, he may even have some left to attract another female. Thornhill reports that a male can sometimes gain as many as three matings from one nuptial gift. A real winner, indeed!

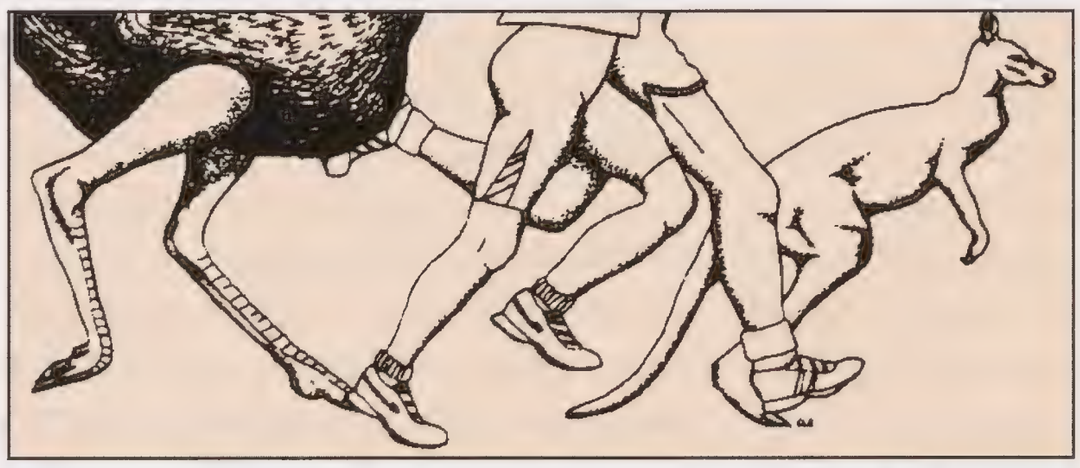
But enter the trickster. Some opportunistic male scorpionflies have found a way to avoid the risks of hunting by acting like transvestites. The ruse works because male and female scorpionflies look alike, even to each other.

When a male intent on deception hangs in front of a courting male and lowers his wings just as a receptive female would, the suitor invariably proffers his nuptial gift. By the time he becomes aware of his mistake, it is too late. The devious fellow has already grabbed the gift and flown off to present it to a female of his own. Female scorpionflies don't care if the goods are hot. In the scorpionfly spin on the universal theme of food in exchange for sex, it's the size of the gift that matters.

Males that can pull off this deceit win in two ways. First, they avoid being caught by predators. And, more important, because it is easier and less time-consuming to steal a gift than it is to hunt one down, they mate more often and leave more offspring than males that do their own hunting.

Gift-giving by males to females is part of the courtship rituals of many animals, including humans. But we are relative newcomers to the mating game. Insects have been doing it for several hundred million years.

Mary Batten is the author of Sexual Strategies: How Females Choose Their Mates, *recently released in paperback by Tarcher/Putnam.*



Cindy Barnard

Running Wild at the Zoo

It's been a year and a half since the FONZ Winterfest Classic 5k Fun Run attracted 300 hardy harriers to the National Zoo for the area's most challenging short-distance run. On Saturday, June 18, the race returns, with a somewhat different course, a considerably warmer weather forecast, and a brand new name: FONZ's Running Wild Classic 5k at the National Zoo.

Traversing the hilly terrain of the Zoo grounds, the TAC-certified course will truly bring out the beast in participants. But "the toughest race you'll ever love" is not without its rewards. All entrants receive a colorful Running Wild Classic 5k T-shirt. Runaround Sue of sponsoring radio station WXTR-FM (XTRA 104.1) will be on hand to energize the field with Great Oldies. After the race, participants can cool down and enjoy free refreshments in the Zoo's Mane Restaurant. And, prizes will be awarded to both male and female winners in Open, Masters, and four age-group categories.

The starting gun will be fired at 7:30 a.m., in an attempt to beat the heat. Registration for the race is only $10 through June 4 ($12 thereafter). Proceeds from the race will support conservation education programs at the National Zoo. To receive an entry form, please call 202.673.4954.

Sunset Serenades

It wouldn't be summer in the city without Sunset Serenades at the Zoo. The free concerts will be held on six consecutive Thursday evenings, from 6:30 to 8:00 p.m., on the stage at Lion/Tiger Hill.

The series opens June 30 with Magpie, a duo performing high-spirited folk music with green themes.

On July 7, the Capital Wind Symphony offers an evening of classical music.

On July 14, enjoy contemporary jazz with Bamboo, a six-piece ensemble featuring Liz Briones.

D-KGB will fill the park with their lilting reggae beat on July 21.

On July 28, WDCU Jazz 90 FM will bring "The Best of Jazz" to the Zoo.

The series winds up on August 4, with the Andean pan flute jazz sounds of Llujkan.

Performances will be canceled only in the event of rain at the beginning of, or during, the show. You may reserve a FONZ picnic basket by calling Food Service at 202.673.4978 at least 24 hours before the concert. Refreshments will also be available at the Mane Restaurant. For more concert information, call 202.673.4717.

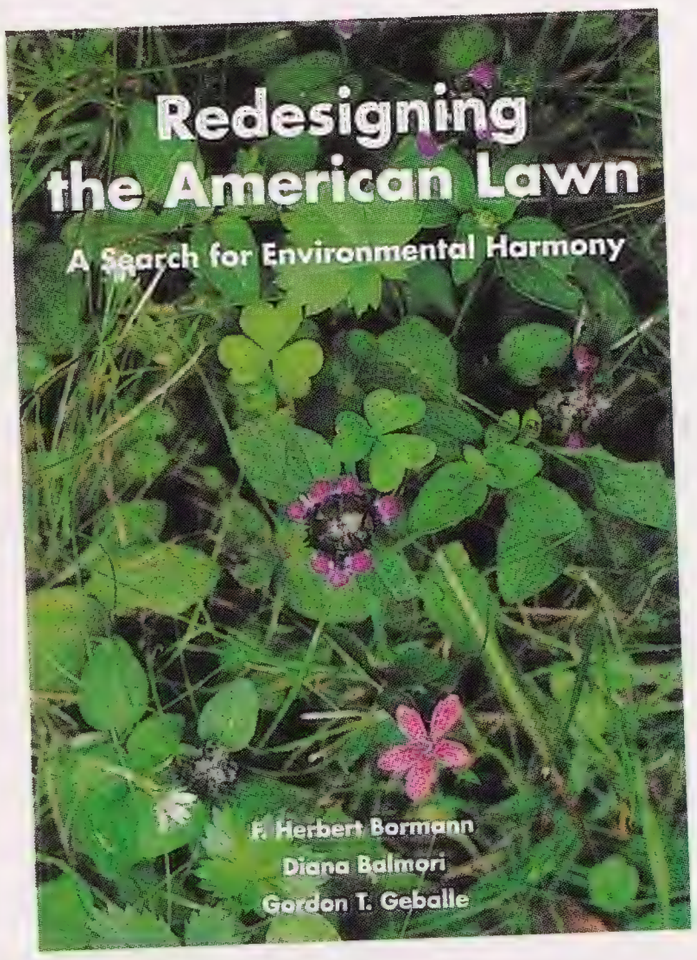
Sunset Serenades/94 is sponsored by Diet Coke.

Picturing Venezuela

A temporary exhibit featuring 100 stunning photographs of Venezuelan wildlife and wild places opens on June 22 and continues until summer's end in the Zoo's Amazonia Gallery. Sponsored by the Venezuelan Embassy, the exhibit highlights the work of some of that country's best nature photographers.

Nominations

Don't forget that your nominations to the FONZ Board of Directors must be received at FONZ by June 30. If you are interested in serving on the volunteer Board—and becoming a real Zoo insider—or know someone else who is interested, call 202.673.4951 to receive Nomination Forms. You can also call this number to talk to Executive Director Clinton A. Fields about service on the Board.



Redesigning the American Lawn: A Search for Environmental Harmony. 1993. F. Herbert Bormann, Diana Balmori, Gordon T. Geballe, and Lisa Vernegaard (Editor-Researcher). Yale University Press, New Haven, Connecticut. 166 pp. hardbound, $19.95.

Improving environmental quality has become an integral part of our national search for greater health and a higher standard of living. Now, Yale professor emeritus F. Herbert Bormann, working with other faculty members and students from Yale's School of Forestry and Environmental Studies and the School of Art and Architecture, has tackled the many environmental questions surrounding our lawns. Professor Bormann is a world-renowned forest and ecosystem ecologist and has made major advancements in our understanding of ecosystem development.

Lawns and turfgrass cover 25 million acres of this country, an area slightly less than that of Pennsylvania. Americans love their lawns and, in many cases, are held captive by them. The challenge for Professor Bormann and his group, as stated in the book's subtitle, "a search for environmental harmony," is how to improve this very important part of our environment, reduce the pollution it creates, generally beautify our everyday landscape, and save money on lawn care in the process.

The authors begin by stating the big connections and questions they want the reader to keep in mind throughout the book: The connection between the lawn and the earth's biosphere; the unanticipated consequences of humanity's alteration of the earth's ecosystems; and the dynamics of lawn ecology, which afford us a small-scale look at the idea of ecological sustainability. As our most familiar landscapes—and our own little pieces of the biosphere—our lawns communicate our concern about the earth's environment.

An array of forces came together over the last century to create the lawned landscape we inhabit today. Unlike the great landscaped manors of England, or George Washington's Mount Vernon lawn that swept from his front porch down to the Potomac River, the lawns we see around us represent a sort of art form for the common person. These lawns are largely the result of the spread of American suburbs with zoning laws that require houses to be significantly set back from the street; of the invention of the lawn mower; and of the development of grass varieties, fertilizers, and pesticides that have permitted the lawn to become the American homeowner's landscape of choice from coast to coast.

Professor Bormann and his group draw a distinction between what they call the "Industrial Lawn"—the typical manicured lawn of mowed grass—and the "Freedom Lawn." The Industrial Lawn is "forced" on a site. It has high environmental and financial costs due to intensive human intervention with insecticides, herbicides, fungicides, fertilizers, and irrigation. Up to 60 percent of urban water use is related to lawn care. Industrial Lawn care is subsidized and made possible through major inputs of fossil energy. Pollution from lawn-care products enters sewage systems, streams, and rivers, and contaminates sites downstream. The authors also list the dangers Industrial Lawn care poses for human health.

The Freedom Lawn, on the other hand, is a mix of grasses and other plants, determined by the interaction between the plants that grow naturally in a given area and the frequency at which

they are mowed. The plants that succeed are stress-tolerant and survive without artificial intervention to produce a green cover adapted to the particular site.

The Freedom Lawn is not, however, what we have come to think of as the typical, well-tended American lawn: all and continuously green, weed-and pest-free, and always closely mowed. The authors argue that switching from our Industrial Lawns to Freedom Lawns makes good environmental and financial sense. But efforts to effect this transition are likely to come up against serious opposition from the lawn industry, which supports the Industrial Lawn, as well as zoning regulations, entrenched aesthetic bias, and other factors.

The authors argue that time, changing aesthetics, our desire to experiment, and environmental consciousness are among the reasons many Americans have begun to challenge the "twelve-inch [high lawn] rule" and the monolithic view of the American lawn. Lawns take a great deal of time to maintain. The weekly mowing, irrigation, and fertilizing can be boring, and very expensive if a lawn-care company is hired to take over the job.

The authors sense that Americans are developing a growing kinship with, and curiosity about, living things, resulting in a more inclusive vision of our lawns and gardens. This growing sensitivity is resulting in a changing aesthetic image of the landscapes where we live and where most of our daily contact with nature occurs.

The authors maintain that Americans love to tinker, invent, and try out innovative ideas. And, as the late Henry Mitchell so joyfully chronicled for years in his *Washington Post* "Earthman" column, what better place to do all this than in the spaces that surround our homes?

Finally, the rise of environmental consciousness, an emerging public view of nature that recognizes the complex, integrated relationships that bind all living things together, and a growing awareness of our birth-to-death contact with dangerous chemicals, are resulting in an increasing number of Americans "thinking globally, but acting locally." And our lawns provide the perfect places to put this credo into action.

The book concludes with the steps we need to take to release the lawn from its industrial dependency. A first step is to change lawn-care practices by selecting the right grass, and then cutting back on mowing and the use of fertilizers, pesticides, herbicides, and irrigation. A second is to reduce the amount of lawn and replace it with a wildflower garden.

A final step is to replace the lawn altogether. The authors offer a number of lawn alternatives, some drawn from other cultures. But, in establishing our yards' new character, they suggest seeking ideas in local landscapes and native species, and establishing a local sense of place by seeking a partnership between our yards and the ecological opportunities and limits of the regions where we live.

This could have been, but is not, a preachy book. It is a book written with full sensitivity to just how important lawns are for most Americans, and it presents environmentally sensitive ideas for individual stewardship of the spaces that surround our homes.

—John Seidensticker
Curator of Mammals

The reviewer's yard in Northwest Washington, D.C. (John Seidensticker)

The Area Scene

In late May and June, the iridescent colors of dragonflies and damselflies become conspicuous in sunny spots on ponds, lakes, and streams throughout the area. Most often seen are males, which guard territories from leafy perches overhanging the water. From the perch, a male hunts flying insect prey—mosquitoes are a primary target—and, much like a hawk, captures prey with his legs before cutting it up with his sharp, biting mouthparts. Males aggressively defend their territories, which on a small pond may be just a few square feet in size, waiting to mate with females coming to the water to lay eggs. Between hunting, fighting, and courting and mating, dragonflies and damselflies are active all day. Stretching out at a quiet spot at water's edge to watch is a fascinating way to while away an early summer's afternoon.

The Good News...

The last time any scientific observer saw a bay cat, and a dead one at that, was 1928. In fact, this secretive Bornean cat *(Catopuma badia)* was known from only six specimens, five collected between 1855 and 1900, and the last in 1928. Although classified as endangered, conservationists didn't have a clue whether or not the species still existed at all, let alone anything about its ecology and behavior. But in late 1992, native trappers arrived at a museum in Sarawak with a dying animal that scientists later identified as a bay cat. This indicates that the species survives, but continued deforestation and habitat loss on the island of Borneo cannot bode well for the future of this virtually unknown little cat.

From Oryx, *January 1994.*

...The Bad News

A less auspicious cat discovery came in India in 1993, when police raided a Tibetan refugee colony in Delhi. They confiscated nearly 1,100 pounds of tiger bones, along with eight tiger skins, 43 leopard skins, and skins and bones of other protected species. The tiger bones were destined for China, where medicinal potions of ground bones fetch huge sums. The confiscated bones represent about 25 tigers; scarier still, one of the arrested smugglers said he could easily acquire another 2,200 pounds within three months—another 50 tigers. This suggests poaching on a massive scale and, with fewer than about 5,000 tigers left in the wild, threatens the species' already precarious future.

From Cat News, *September 1993.*

What's In a Name?

The secretary bird is a large raptor of the African savanna. It hunts mainly on the ground, using its strong legs and feet to stamp snakes, rats, lizards, and locusts to death before eating them. Most accounts relate that this bird got its common name from the long plumes that cascade from its head. European settlers, or so the story goes, found the look reminiscent of a lawyer's clerk carrying quill pens behind his ears.

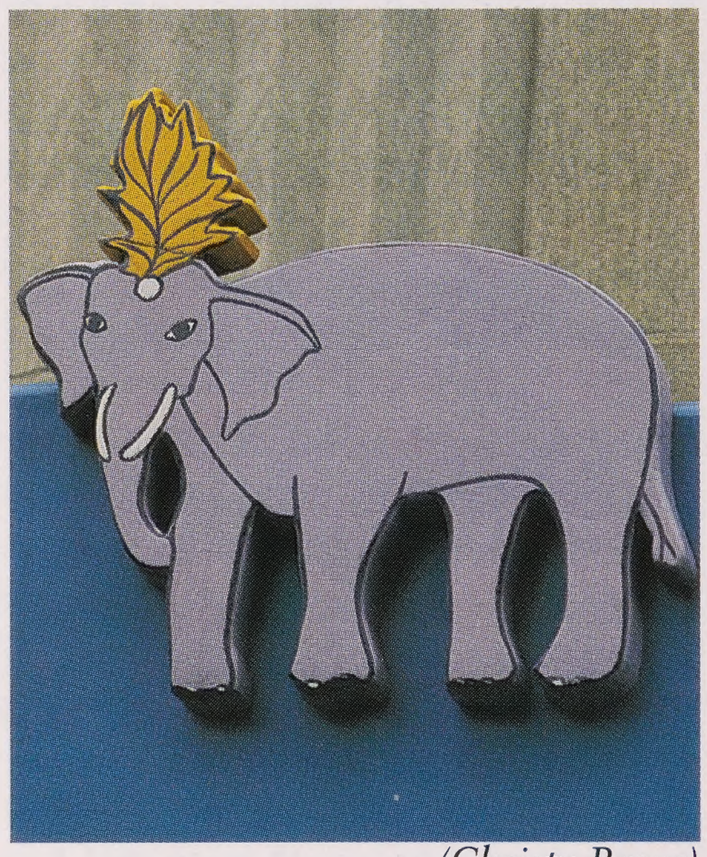
In 1769, however, Arnout Vosmaer told a different story. He reported that this bird was known as *saggitaire*, French for archer, to settlers in South Africa. According to Vosmaer, the bird's striding gait reminded people of an archer advancing to shoot. Further, he pointed out that some locals had corrupted the name to secretaire, or secretary. This story rings true in that the bird's scientific name, *Sagittarius serpentarius*, means snake-eating archer.

Clean Air Cabs

Huge numbers of cabs ply the streets of Washington, D.C., but one company hopes to stand out among the crowd by going green. Clean Air Cabs are blue and white, covered with fluffy white clouds, and the only taxis in the area that run on natural gas. Unfortunately, you might have to wait awhile to hail one. Just six of these environmentally friendly vehicles are now on the road although the company plans to increase that number to more than 20 by the end of the year.

Urban Animal Safari

The Washington metropolitan area provides ideal habitat for a variety of wild animal artistic creations. These lively, if inanimate, creatures range all over the region, from our most famous public places to the most secluded private lairs. Pictured here is one of these fantastic animals—do you know where to spot it? (Look for the answer in our May/June issue.)



(Christy Bowe)

Answer to the January-February Urban Animal Safari: Gangplank Restaurant, 600 Water Street, SW, Washington, D.C.

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